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MACHINE AND HAND METHODS IN CROP PRODUCTION

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MECHANIZATION HAS EXPANDED RAPIDLY 1/

Today more than half of the breaking and disking of the land and about 70 percent of the harvesting of small grains are done with mechanical power. Thirty years ago there were practically no tractors or auto trucks on farms and not many automobiles. Tractors in 1910 were used largely for stationary farm work. In 1939, there were more than 1,600,000 tractors on farms — more than 900,000 trucks and more than 4,000,000 automobiles (table 1). This increase in mechanical power has not been accompanied by any significant change in size of agricultural plant.

From 1910 to 1920 the percentage increase in numbers of horses and mules (over 2 years of age) was about equal to the increase in cropland. Since 1920, with the rapid increase in mechanical power there has been a drastic reduction in numbers of horses and mules. Acreage of land for crop use in 1915 and in 1939 was at approximately the same level but in 1939 horse and mule numbers had declined by more than 8,000,000 head — a decline of around 38 percent. Since 1915, tractor numbers have increased by 1,575,000; auto truck numbers, by 900,000; and automobile numbers, by more than 3,600,000 — the total increase in all motor units since 1915 amounting to over 6,000,000.

1/ 26, 756 crop correspondents of the Agricultural Marketing Service supplied information relative to machine and hand methods used in performing specific operations in the production of major crops of 1939. The data were applicable to the localities in which the crop correspondents lived rather than to their own farms. This material was analyzed in the Bureau of Agricultural Economics. Cora L. Whitmer, Caroline G. Towles, Edith E. Snow and other members of the staff assisted in the computations.

Table 1. - Numbers of horses and mules, tractors, auto trucks, and automobiles, total for United States in designated years

Year	Horses and mules 2 years old and over on farms, Jan. 1	Tractors on farms, Jan. 1	Trucks on farms, Jan. 1	Automobiles on farms, Jan. 1
	Thousands	Thousands	Thousands	Thousands
1910	19,429	4	0	50
1915	21,866	37	25	472
1920	22,386	343	139	2,146
1925	21,038	621	459	3,283
1930	17,981	997	900	4,135
1935	15,471	1,130	890	3,642
1939	13,615	1,610	925	4,101

Wide variations exist in the use of machine power throughout the country. The areas most mechanically developed are the Great Plains, the Corn Belt, the Rocky Mountains, and the Pacific Coast. Animals are still the chief source of power along the Atlantic Coast, the Cotton Belt and bordering States. The type of crop produced is also important in determining the extent to which farmers are using mechanical power.

Mechanical power has been widely adopted in the production of small grains and in preparing seedbed for corn. In general, farmers tend to use tractors for heavy-duty operations. Horse and mules, however, are still predominant in cotton production, planting and cultivating potatoes, cutting and hauling hay, and for light operations in corn production.

MECHANICAL POWER EXTENSIVELY USED FOR SEEDBED PREPARATION

Most of the land on which crops are planted is broken, plowed, listed or bedded before it is planted. As breaking land and disking is heavy work, more work animals are displaced in these operations by tractors with the usual facilities available than is true in light work

such as planting and cultivating. Only about 25 percent of the farmers in the United States had tractors in 1939 but more than half of the breaking and disking of land was done with tractors (table 2). Farms with tractors are much larger than the average of all farms, and many tractor owners do custom work.

Tractor power was used for more than 70 percent of the land breaking and disking in the Pacific Coast States and West North Central States; about two-thirds of the land breaking and disking in the Mountain and East North Central States was done with tractor power and about half in the Middle Atlantic States.

In the remaining groups of States the bulk of the power for breaking land and disking was supplied by animals. Tractor power is used most extensively in areas where the farms are of large size and where the various operations of crop production can be effectively done by machine methods. Use of tractors in the Eastern Cotton Belt and in some of the border States was relatively insignificant.

The report shows that most of the power for harrowing is still supplied by workstock. Harrowing is much lighter work than breaking and disking land, and a day's work with a tractor displaces fewer work animals and effects a smaller saving in labor than is the case for heacy work.

Manure Spreaders Extensively Used

The reports from crop correspondents show that there is a wide variation in the proportion of farm manure that is applied with manure spreaders. Spreaders are extensively used in the Corn Belt, the Northeastern States, and in some Mountain States. They are also used to a considerable extent in the Pacific Coast States.

In the States where spreaders are used extensively many farms have large numbers of livestock that are housed or confined in feed lots throughout the winter. In the Cotton Belt and in States bordering the Belt manure spreaders are used but little. In these Southern States, numbers of livestock kept per farm are usually small and with the long pasture season much of the manure is dropped on pastures or on fields.

SMALL GRAIN PRODUCTION HIGHLY MECHANIZED

Mechanical power is used to a greater extent for producing small grains than for any other major crop. Use of large machines and large units of power in the production of small grain was established in many areas long before the internal combustion engine was adapted to field work. For the entire country more than 70 percent of the breaking of land and disking for grain production was done with tractors in 1939. Almost as large an acreage was harvested with mechanical power (table 3). However, for the relatively light jobs of harrowing and drilling, the use of animal power was of greater importance than the use of mechanical power.

Table 2. - The use of tractor and animal power for breaking, disking, and harrowing land; and use of manure spreader for handling manure; by States, 1939 1/

State and division	Breaking land 2/		Disking		Harrowing 3/		Manure spread 4/
	Tractor power	Animal power	Tractor power	Animal power	Tractor power	Animal power	With spreader
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Maine	33	67	45	55	38	62	52
New Hampshire	47	53	55	45	46	54	59
Vermont	26	74	42	58	31	69	54
Massachusetts	51	49	60	40	48	52	59
Rhode Island	60	40	65	35	40	60	66
Connecticut	50	50	57	43	42	58	70
New England	40	60	51	49	40	60	53
New York	52	48	65	35	56	44	46
New Jersey	71	29	82	18	60	40	54
Pennsylvania	42	58	57	43	43	57	69
Middle Atlantic	48	52	62	38	50	50	56
Ohio	56	44	64	36	47	53	77
Indiana	67	33	71	29	53	47	71
Illinois	79	21	79	21	60	40	71
Michigan	48	52	53	47	45	55	76
Wisconsin	54	46	54	46	35	65	76
East North Central	64	36	67	33	50	50	74
Minnesota	71	29	64	36	48	52	73
Iowa	80	20	73	27	62	38	89
Missouri	43	57	47	53	26	74	37
North Dakota	78	22	72	28	53	47	55
South Dakota	80	20	75	25	64	36	72
Nebraska	73	27	70	30	59	41	74
Kansas	85	15	83	17	77	23	63
West North Central	74	26	70	30	57	43	72

Delaware	53	47	58	42	33	67	61
Maryland	38	62	56	44	32	68	65
Virginia	14	86	30	70	14	86	30
West Virginia	8	92	14	86	7	93	16
North Carolina	14	86	28	72	9	91	7
South Carolina	14	86	24	76	10	90	3
Georgia	7	93	16	84	7	93	3
Florida	19	81	35	65	15	85	4
South Atlantic	14	84	26	74	11	89	19
Kentucky	15	85	25	75	10	90	17
Tennessee	12	88	23	77	8	92	12
Alabama	11	89	22	78	8	92	4
Mississippi	10	90	20	80	7	93	3
East South Central	12	88	23	77	8	92	11
Arkansas	9	91	15	85	9	91	6
Louisiana	15	85	21	79	11	89	5
Oklahoma	54	46	55	45	48	52	14
Texas	46	54	48	52	37	63	7
West South Central	41	59	44	56	34	66	8
Montana	79	21	73	27	62	38	42
Idaho	49	51	43	57	26	74	55
Wyoming	65	35	54	46	37	63	41
Colorado	68	32	65	35	47	53	61
New Mexico	56	44	50	50	37	63	19
Arizona	84	16	82	18	64	36	24
Utah	49	51	39	61	28	72	52
Nevada	62	38	55	45	36	64	52
Mountain	68	32	62	38	48	52	51
Washington	62	33	67	33	50	50	52
Oregon	65	35	66	34	49	51	47
California	88	12	90	10	76	24	42
Pacific	76	24	79	21	63	37	46
United States	55	45	57	43	43	57	58

1/ Acreage of land for crop use, exclusive of hay crops, as reported in the 1935 U. S. Census, was used in computing averages by geographic divisions and the United States, for breaking land, disking, and for harrowing.

2/ Includes plowing with mold board and disk plows, listing, bedding and middle busting.

3/ Includes harrowing with spike tooth and spring tooth harrow.

4/ For manure, averages for geographic divisions and the United States, were arrived at by weighting the estimated tonnage of manure applied to crop and pasture land in the individual States.

Table 3. - Importance of tractor power, animal power and hand methods for producing small grains, by States, 1939 1/

State and division	Acreage broken 2/		Acreage disked		Acreage harrowed		Acreage drilled		Acreage harvested			Haul to market with -		
									Cut with machines drawn by -					
	Tractor power	Animal power	Tractor power	Animal power	Tractor power	Animal power	Tractor power	Animal power	Cradle	Tractor	Animal	Auto or truck	Tractor	Animal
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Maine	28	72	51	49	58	42	8	92	2	27	71	80	1	19
New Hampshire	47	53	55	45	46	54	20	80	4	20	76	78	-	22
Vermont	26	74	42	58	31	69	8	92	3	20	77	83	-	17
Massachusetts	51	49	60	40	48	52	24	76	1	52	47	64	-	36
Rhode Island	60	40	65	35	40	60	54	46	10	56	34	99	-	1
Connecticut	50	50	57	43	42	58	10	90	-	27	73	82	-	18
New England	30	70	49	51	50	50	9	91	2	26	72	81	-	19
New York	54	46	66	34	57	43	8	92	-	38	62	89	1	10
New Jersey	69	31	81	19	64	36	26	74	-	65	35	91	-	9
Pennsylvania	43	57	57	43	43	57	10	90	2	48	50	89	1	10
Middle Atlantic	48	52	61	39	49	51	10	90	1	45	54	89	1	10
Ohio	63	37	70	30	53	47	19	81	1	60	39	85	2	13
Indiana	69	31	73	27	56	44	32	68	-	66	34	86	2	12
Illinois	80	20	79	21	60	40	36	64	-	76	24	88	1	11
Michigan	53	47	57	43	48	52	12	88	-	42	58	87	2	11
Wisconsin	56	44	57	43	38	62	10	90	1	32	67	82	1	17
East North Central	67	33	69	31	52	48	24	76	-	58	42	86	2	12
Minnesota	72	28	66	34	51	49	31	69	-	67	33	90	1	9
Iowa	82	18	75	25	64	36	32	68	-	81	19	89	1	10
Missouri	50	50	51	49	30	70	24	76	-	58	42	85	1	14
North Dakota	79	21	73	27	54	46	53	47	-	65	35	87	2	11
South Dakota	80	20	75	25	64	36	61	39	-	77	23	88	2	10
Nebraska	76	24	72	28	61	39	62	38	-	81	19	87	2	11
Kansas	88	12	87	13	82	18	82	18	-	90	10	94	1	5
West North Central	78	22	74	26	61	39	53	47	-	75	25	89	1	10

Delaware	55	45	59	41	37	63	24	76	-	59	41	86	-	14
Maryland	36	64	55	45	33	67	6	94	1	45	54	93	1	6
Virginia	15	85	31	69	15	85	6	94	12	35	53	83	1	16
West Virginia	11	89	21	79	11	89	3	97	35	19	46	74	2	24
North Carolina	15	85	30	70	8	92	6	94	20	44	36	75	1	24
South Carolina	14	86	23	77	10	90	10	90	20	31	49	75	-	25
Georgia	7	93	15	85	6	94	5	95	36	21	43	60	1	39
Florida	19	81	35	65	15	85	3	97	29	1	70	60	-	40
South Atlantic	17	83	30	70	14	86	7	93	19	35	46	76	1	23
Kentucky	17	83	29	71	12	88	6	94	4	36	60	76	1	23
Tennessee	13	87	23	77	8	92	3	97	10	27	63	76	1	23
Alabama	10	90	19	81	6	94	7	93	26	14	60	52	-	48
Mississippi	17	83	30	70	15	85	17	83	6	19	75	46	1	53
East South Central	14	86	25	75	10	90	5	95	9	29	62	72	1	27
Arkansas	17	83	28	72	15	85	12	88	7	18	75	39	-	61
Louisiana	38	62	45	55	33	67	35	65	1	52	47	84	-	16
Oklahoma	70	30	70	30	64	36	70	30	1	80	19	89	1	10
Texas	72	28	73	27	65	35	73	27	1	81	18	90	2	8
West South Central	68	32	68	32	62	38	68	32	1	77	22	88	1	11
Montana	84	16	78	22	68	32	71	29	-	71	29	95	-	5
Idaho	51	49	45	55	28	72	27	73	-	45	55	89	1	10
Wyoming	72	28	64	36	44	56	45	55	-	58	42	93	2	5
Colorado	75	25	71	29	54	46	53	47	1	65	34	93	-	7
New Mexico	64	36	57	43	47	53	65	35	2	62	36	93	3	4
Arizona	88	12	87	13	73	27	68	32	2	80	18	90	1	9
Utah	50	50	41	59	29	71	19	81	-	43	57	83	-	17
Nevada	61	39	54	46	33	67	7	93	-	40	60	93	1	6
Mountain	75	25	69	31	56	44	57	43	-	64	36	93	-	7
Washington	78	22	81	19	71	29	71	29	-	79	21	96	-	4
Oregon	68	32	70	30	53	47	47	53	-	64	36	95	1	4
California	88	12	90	10	78	22	79	21	-	89	11	96	2	2
Pacific	79	21	82	18	69	31	68	32	-	79	21	96	1	3
United States	71	29	70	30	57	43	48	52	1	69	30	89	1	10

1/ 1939 acreage weights of all small grains were used in computing averages for geographic divisions and the United States for breaking land, disking, harrowing, drilling and harvesting. In computing averages for hauling to market, 1939 production weights of all small grains were used.

2/ Includes plowing with mold board and disk plows, listing, bedding and middle busting.

Workstock supplied the power for operating drills on more than half of the acreage of small grains that was drilled. Tractor use in grain production was most pronounced in the Pacific, North Central and Mountain States. Workstock supplied most of the power in the South Atlantic, East South Central, and New England States.

In most States, tractor power was used to a greater extent for breaking land and disking than for harvesting small grains, but, in the South Atlantic and East South Central States, this tendency was reversed.

Cradling Persists in South

One percent of the country's small grain acreage is cut with a cradle. Cradling was of most importance in the South Atlantic States where about 20 percent of the average is cradled.

According to the reports about 90 percent of the small grains are hauled to local markets with auto trucks. Tractors are used as a source of power for hauling only 1 percent of the small grains. Teams are still used for marketing small grains, but only a small part of the quantity marketed is hauled with teams in the important, surplus-producing, small-grain States.

TRACTORS IMPORTANT FOR HEAVY-DUTY WORK IN CORN

Mechanical power is not quite so widely used in the Corn Belt as in the Plains, but more than half of the breaking of land and disking for corn is done with tractor power and about 40 percent of the harrowing is done with tractor-drawn equipment. Planting and cultivating corn, relatively light work, still favor animals, for tractors are used for only 13 percent and 30 percent, respectively, in this work (table 4).

Use of tractor power in corn production was most pronounced in the Corn Belt, the Great Plains and the Mountain States, but tractor use was fairly important, especially for heavy duty operations, in the Middle Atlantic and New England States. Tractors were used relatively little in the South Atlantic and East South Central States but were used much more for heavy work than for light work.

Hand methods still persist in some operations, notwithstanding the tendency toward mechanization. According to the survey, 43 percent of the acreage of corn cut in 1939 was cut by hand methods. Power for operating binders or other cutting devices was supplied largely by workstock.

Planting corn by hand still persists to some extent in States where the corn acreage per farm is small.

MECHANICAL POWER IN COTTON PRODUCTION

Mechanization has made the least headway in cotton production. Small farms, the need for hand labor for hoeing and harvesting, and topographic conditions have been the major factors responsible for the small degree of mechanization. This applies especially to the cotton-producing areas east of the Mississippi River and to the hilly areas west of the Mississippi.

Use of mechanical power for producing cotton is most pronounced in areas where large acreages of cotton are grown per farm family and where the fields are sufficiently level to permit effective use of large machines.

The most extensive use of mechanical power for producing cotton is found in California and Arizona where the cotton is irrigated (table 5). Tractors are also used quite widely in western Texas, western Oklahoma, the Black Prairie and Coastal Prairie of Texas, and in New Mexico. Work-stock supplies most of the power for producing cotton in eastern Texas and eastern Oklahoma. In the River Bottom Areas of the States that border the Mississippi River, tractors are used to an appreciable extent. East of the Mississippi River, and in the hilly areas of Arkansas and Louisiana, tractors are used to some extent for preparing the seedbed but their use in planting and cultivating is very limited.

WORKSTOCK - CHIEF SOURCE OF POWER IN HAY MAKING

Horses are still used in cutting about 85 percent of the total hay acreage in the country in 1939 (table 6). Horse-drawn mowers cut more than 90 percent of the hay acreage in the South Atlantic States and the East South Central States, and about 95 percent of the hay acreage in West Virginia, North Carolina, and Tennessee. Use of tractor-drawn mowers is most important in the Pacific Coast and New England States. In most Corn Belt States, around 10 to 15 percent of the acreage is cut with tractor-drawn mowers.

Workstock also contributes 85 percent of the total power for hauling the hay from the field to barns or stacks. Use of tractors and trucks for hauling was relatively important in States where tractors were most used for cutting hay. In New England, the Middle Atlantic, the East North Central, and the Pacific Coast States, the use of tractors and trucks for removing hay was more common than was the use of tractors for operating mowers. In the remaining group of States, tractor-drawn mowers cut more hay than was hauled by tractors and trucks.

With their present facilities for hay making, many farmers appear to prefer workstock for hauling hay to fields or barns. Unless large size equipment is available and a long haul is entailed, little saving in labor can be effected by the use of motor power. Hauling hay is a relatively light draft operation and the displacement of workstock is not sufficient for farmers to use mechanical power when teams are available.

Table 4. - Importance of hand methods, tractor power and animal power for preparing land, planting, cultivating and cutting corn, by States, 1939

State and division	Breaking land 1/		Disking		Harrowing		Planting			Culti-vating		Cultivating corn		
								With planters drawn by -					With machine drawn by -	
	Trac-tor power	Ani-mal power	Trac-tor power	Ani-mal power	Trac-tor power	Ani-mal power	By hand method	Trac-tor	Ani-mal	Trac-tor power	Ani-mal power	By hand	Trac-tor	Ani-mal
	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent	Per-cent
Maine	36	64	45	55	34	66	14	9	77	11	89	58	7	35
New Hampshire	47	53	55	45	46	54	15	14	71	20	80	53	10	37
Vermont	26	74	42	58	31	69	6	5	89	8	92	38	15	47
Massachusetts	51	49	60	40	48	52	32	9	59	12	88	56	20	24
Rhode Island	60	40	65	35	40	60	21	42	37	43	57	54	28	18
Connecticut	50	50	57	43	42	58	35	8	57	13	87	77	14	9
New England	40	60	51	49	39	61	20	9	71	13	87	54	14	32
New York	52	48	65	35	55	45	18	5	77	10	90	24	25	51
New Jersey	69	31	81	19	61	39	27	11	62	33	67	75	16	9
Pennsylvania	45	55	58	42	44	56	5	6	89	17	83	68	11	21
Middle Atlantic	49	51	62	38	49	51	11	6	83	16	84	53	16	31
Ohio	62	38	69	31	53	47	3	5	92	40	60	58	12	30
Indiana	69	31	73	27	57	43	1	9	90	47	53	57	18	25
Illinois	82	18	81	19	62	38	-	9	91	52	48	36	31	33
Michigan	52	48	56	44	47	53	21	6	73	21	79	46	13	41
Wisconsin	56	44	57	43	36	64	11	3	86	18	82	17	16	67
East North Central	70	30	72	28	55	45	4	7	89	42	58	41	17	42
Minnesota	73	27	66	34	51	49	3	7	90	43	57	8	33	59
Iowa	82	18	75	25	64	36	-	10	90	58	42	10	50	40
Missouri	50	50	51	49	29	71	3	7	90	22	78	60	14	26
North Dakota	77	23	70	30	50	50	1	13	86	19	81	2	37	61
South Dakota	80	20	75	25	64	36	-	25	75	57	43	1	50	49
Nebraska	74	26	70	30	58	42	-	50	50	56	44	5	56	39
Kansas	76	24	72	28	63	37	-	45	55	46	54	5	58	37
West North Central	74	26	69	31	56	44	1	22	77	48	52	13	43	44

Delaware	52	48	60	40	31	69	5	6	80	16	84	95	2	3
Maryland	40	60	61	39	33	67	3	2	95	12	88	85	4	11
Virginia	15	85	31	69	15	85	8	2	90	5	95	92	1	7
West Virginia	9	91	16	84	8	92	60	–	40	2	98	95	1	4
North Carolina	12	88	24	76	8	92	5	1	94	2	98	81	2	17
South Carolina	14	86	22	78	9	91	10	1	89	2	98	68	3	29
Georgia	7	93	15	85	8	92	14	1	85	2	98	70	2	28
Florida	19	81	35	65	15	85	13	3	84	3	97	64	1	35
South Atlantic	13	87	24	76	11	89	12	1	87	3	97	84	2	14
Kentucky	14	86	25	75	10	90	21	1	78	6	94	88	1	11
Tennessee	13	87	25	75	9	91	6	1	93	5	95	72	2	26
Alabama	10	90	18	82	7	93	15	3	82	4	96	65	3	32
Mississippi	12	88	23	77	10	90	9	4	87	4	96	44	4	52
East South Central	12	88	23	77	9	91	13	2	85	5	95	74	2	24
Arkansas	13	87	19	81	12	88	13	4	83	7	93	67	5	28
Louisiana	16	84	20	80	10	90	16	3	81	5	95	57	4	39
Oklahoma	33	67	35	65	28	72	2	15	83	14	86	13	36	51
Texas	34	66	35	65	25	75	5	26	69	25	75	32	28	40
West South Central	27	73	30	70	21	79	8	16	76	16	84	38	22	40
Montana	82	18	76	24	63	37	11	22	67	15	85	27	24	49
Idaho	45	55	40	60	22	78	15	5	80	9	91	49	15	36
Wyoming	77	23	71	29	49	51	4	33	63	35	65	26	24	50
Colorado	78	22	76	24	56	44	1	53	46	49	51	18	35	47
New Mexico	60	40	54	46	43	57	3	48	49	41	59	34	19	47
Arizona	79	21	64	36	49	51	55	5	40	26	74	50	25	25
Utah	44	56	33	67	23	77	32	7	61	4	96	65	5	30
Nevada	58	42	60	40	26	74	10	39	51	52	48	49	38	13
Mountain	75	25	70	30	53	47	4	44	52	41	59	31	25	44
Washington	57	43	63	37	44	56	50	6	44	14	86	76	7	17
Oregon	62	38	63	37	46	54	46	7	47	13	87	79	8	13
California	86	14	90	10	73	27	8	41	51	43	57	42	45	13
Pacific	71	29	73	27	56	44	32	20	48	25	75	68	17	15
United States	51	49	53	47	39	61	6	13	81	30	70	43	22	35

1/ Includes plowing with mold board and disk plows, listing, bedding, and middle busting.

Table 5. - Importance of animal and machine power in producing cotton, by States, 1939 1/

State and division	Acreage broken 2/		Acreage harrowed		Acreage planted		Acreage cultivated		Hauled to gin
	Tractors	Animals	Tractors	Animals	Tractors	Animals	Tractors	Animals	Animals
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
North Carolina	14	86	9	91	1	99	1	99	52
South Carolina	14	86	9	91	1	99	1	99	53
Georgia	7	93	8	92	1	99	1	99	53
South Atlantic	11	89	8	92	1	99	1	99	53
Tennessee	16	84	14	86	1	99	6	94	67
Alabama	10	90	7	93	3	97	5	95	60
Mississippi	16	84	13	87	6	94	7	93	57
East South Central	14	86	11	89	4	96	6	94	59
Missouri	24	76	20	80	4	96	13	87	52
Arkansas	14	86	13	87	3	97	6	94	65
Louisiana	15	85	11	89	3	97	4	96	50
Oklahoma	44	56	38	62	28	72	25	75	43
Texas	49	51	40	60	45	55	43	57	40
West South Central 3/	40	60	33	67	32	68	31	69	45
New Mexico	49	51	34	66	39	61	41	59	13
Arizona	89	11	77	23	65	35	76	24	3
California	85	15	71	29	71	29	73	27	5
United States	30	70	25	75	22	78	22	78	49

1/ 1939 acreage weights were used in computing averages for geographic divisions and for United States, for breaking land, harrowing, planting, and cultivating.

2/ Includes plowing with moldboard and disk plows, listing, bedding, and middle busting.

3/ Includes Missouri of the West North Central States.

It appears that farmers who use mechanical power for cutting hay and for hauling hay, fall largely in two classes: (1) Those who have a large hay acreage and large-size hay making equipment, and (2) those whose farms are mechanized and who have no workstock available for haying operations.

No information was obtained from crop correspondents relative to the power used for raking hay. However, animal power has a greater advantage in raking hay than in any of the jobs mentioned, since less power is required. Thus, it appears likely that work animals are used to a greater extent for raking hay than for cutting hay or hauling hay from fields.

Amount of Hay Baled and Kind of Baler Used

Most of the hay produced in 1939 was stored loose in barns, or stacked. Although only 14 percent of the 1939 hay production was baled there were individual States where more than half of the hay was baled (table 6). The baling of hay was most pronounced along the southern border from Georgia to California. Little hay was baled in the northeastern part of the country, the Corn Belt or in the Northern Great Plains.

Of the hay baled, 88 percent was baled with stationary balers and the remainder with windrow pick-up balers, a fairly recent development. This baler is now used to the greatest extent in Arizona and California, but its use is reported in practically all States.

TRACTOR USE LIMITED IN POTATO PRODUCTION

Workstock supplied the power for cultivating about five-sixths of the country's potato acreage in 1939. Use of tractors for cultivating was important in California, Nebraska, Rhode Island and New Jersey. In the 10 western surplus late potato States about one-third of the cultivating was done with tractors. In the 5 central other late States and in the intermediate States, tractors were used relatively little for cultivating.

Machine planting generally prevailed in the States which are important producers of potatoes for markets. In such States large acreages of potatoes are produced on many farms and under these conditions machine planters contribute to lower production costs.

However, in States and areas where potatoes are grown largely for farm and local use, hand planting methods prevail. The potato acreage in most instances is too small to permit of using machine planters economically. In most States the planters were drawn by work animals but there were some States where tractor-drawn planters were used principally (table 7).

Table 6. - Use of mechanical and animal power for specified haying operations, the percentage of the hay crop baled, and the type of baler used, by States, 1939

State and division	Hay acreage cut with mowers drawn by		Hay hauled or drawn to barn or stack with		Percentage of hay produced which was baled	Percentage of hay baled with	
	Tractors	Work-stock	Tractor & truck	Work-stock		Stationary baler	Windrow pickup balers
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Maine	26	74	28	72	1.7	99	1
New Hampshire	29	71	30	70	3.0	89	11
Vermont	11	89	17	83	4.8	100	-
Massachusetts	29	71	36	64	0	100	-
Rhode Island	36	64	39	61	.4	-	-
Connecticut	31	69	42	58	.8	100	-
New England	23	77	28	72	2.5	98	2
New York	14	86	19	81	7.0	96	4
New Jersey	26	74	38	62	8.0	80	20
Pennsylvania	14	86	20	80	9.0	93	7
Middle Atlantic	14	86	20	80	7.0	94	6
Ohio	9	91	16	84	9.0	91	9
Indiana	13	87	13	87	8.0	79	21
Illinois	15	85	13	87	18.0	66	34
Michigan	14	86	12	88	4.0	99	1
Wisconsin	9	91	14	86	2.0	95	5
East North Central	12	88	14	86	7.8	87	13
Minnesota	11	89	14	86	3.0	90	10
Iowa	14	86	21	79	5.0	80	20
Missouri	10	90	5	95	15.0	92	8
North Dakota	11	89	7	93	3.6	98	2
South Dakota	25	75	12	88	2.4	97	3
Nebraska	30	70	14	86	5.0	92	8
Kansas	26	74	18	82	24.0	92	8
West North Central	17	83	14	86	7.1	90	10
Delaware	16	84	22	78	5.0	100	-
Maryland	11	89	16	84	7.0	95	5
Virginia	7	93	6	94	9.0	94	6
West Virginia	4	96	6	94	5.0	85	15
North Carolina	4	96	4	96	31.0	91	9
South Carolina	8	92	3	97	35.0	83	17
Georgia	8	92	3	97	61.0	83	17
Florida	16	84	16	84	50.0	76	24
South Atlantic	7	93	6	94	23.3	89	11

Table 6. - Use of mechanical and animal power for specified haying operations, the percentage of the hay crop baled, and the type of baler used, by States, 1939 - Continued

State and division	Hay acreage: Cut with mowers drawn by: Tractors	Hay acreage: Cut with mowers drawn by: Work-stock	Hay hauled or drawn to barn or stack with: Tractor & truck	Hay hauled or drawn to barn or stack with: Work-stock	Percentage of hay which was baled	Percentage of hay baled with: Stationary baler	Percentage of hay baled with: Windrow pickup balers
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Kentucky	6	94	5	95	31.0	92	8
Tennessee	5	95	2	98	31.0	95	5
Alabama	11	89	4	96	50.0	84	16
Mississippi	12	88	6	94	32.0	82	18
East South Central	8	92	4	96	34.0	90	10
Arkansas	8	92	5	95	43.0	87	13
Louisiana	8	92	6	94	29.0	82	18
Oklahoma	25	75	21	79	50.0	93	7
Texas	19	81	18	82	55.0	88	12
West South Central	17	83	14	86	47.3	89	11
Montana	15	85	11	89	3.0	91	9
Idaho	16	84	7	93	1.3	98	2
Wyoming	24	76	10	90	6.0	96	4
Colorado	24	76	15	85	6.0	97	3
New Mexico	18	82	24	76	37.0	77	23
Arizona	46	54	38	62	45.0	34	66
Utah	11	89	11	89	5.0	84	16
Nevada	10	90	4	96	13.0	67	34
Mountain	19	81	12	88	7.2	89	11
Washington	19	81	23	77	15.0	95	5
Oregon	22	78	16	84	16.0	96	4
California	34	66	38	62	51.0	52	48
Pacific	27	73	30	70	34.9	72	28
United States	15	85	15	85	14.0	88	12

Table 7.- Importance of animal power, tractor power, and hand methods in planting and cultivating potatoes by States, 1939

State and division	Planted acreage			Cultivated acreage	
	By hand	Tractor power	Animal power	Tractor power	Animal power
	Percent	Percent	Percent	Percent	Percent
Surplus Late					
Maine	12	16	72	27	73
New York	42	20	38	19	81
Pennsylvania	40	11	49	11	89
Eastern	32	16	52	19	81
Michigan	67	5	28	8	92
Wisconsin	62	2	36	5	95
Minnesota	40	13	47	13	87
North Dakota	17	35	48	31	69
South Dakota	36	11	53	18	82
Central	48	12	40	13	87
Nebraska	24	51	25	54	46
Montana	58	7	35	5	95
Idaho	11	14	75	14	86
Wyoming	14	39	47	44	56
Colorado	9	38	53	32	68
Utah	29	3	68	4	96
Nevada	54	8	38	2	98
Washington	35	12	53	10	90
Oregon	44	18	38	14	86
California	20	64	16	68	32
Western	21	32	47	32	68
Other Late					
New Hampshire	56	6	38	19	81
Vermont	74	5	21	5	95
Massachusetts	62	19	19	20	80
Rhode Island	46	33	21	54	46
Connecticut	56	16	28	17	83
New England	61	14	25	18	82
West Virginia	89	1	10	1	99
Ohio	47	6	47	7	93
Indiana	72	5	23	11	89
Illinois	78	1	21	4	96
Iowa	72	2	26	11	89
Central	64	4	32	7	93
Intermediate					
New Jersey	18	36	46	44	56
Delaware	69	1	30	3	97
Maryland	58	3	39	2	98
Virginia	44	2	54	1	99
Kentucky	77		23		100
Missouri	78	1	21	1	99
Kansas	69	10	21	14	86
Total	54	9	37	10	90
United States	42	16	42	17	83